2008 Water Testing Summary Report for Moose Pond

Lakes Environmental Association

Please join LEA!

If you swim, boat, fish or simply believe Maine wouldn't be Maine without clear, clean lakes and ponds, please join the Lakes Environmental Association and protect Maine's lakes now and for future generations. Our lakes face serious threats, from erosion to invasive plants. Since 1970, LEA has worked to protect the lakes and ponds of Western Maine through water quality testing, watershed education and outreach programs.

37 lakes tested

LEA protects water quality by helping landowners avoid problems such as erosion and by testing the waters of 37 lakes in Western Maine with help from volunteers and support from the Towns of Bridgton, Denmark, Harrison, Naples, Sweden and Waterford.

LEA leads the milfoil battle

Invasive aquatic plants, such as milfoil, are not native to Maine waters. Once they invade a lake or stream, they:

- Spread rapidly and kill beneficial native plants.
- Form dense mats of vegetation, making it difficult to swim, fish or boat.
- Alter native fish habitats
- Lower waterfront property values.

Watershed education

LEA offers environmental education programs to local schools, reaching roughly 500 students annually. Many more people enjoy nature at LEA's Holt Pond Preserve and others join in the Caplan Series of nature pro-

Landowner and Municipal Assistance

LEA provides free technical assistance to watershed residents interested in preventing erosion on their property. This service, called the "Clean Lake Check Up" helps educate citizens about simple erosion control techniques and existing land use regulations. LEA also works with municipalities on comprehensive planning, natural resources inventories and ordinance development.

Thousands of students have learned about watersheds on LEA's "Hey You!" cruises.

You can become an LEA member with a donation of any amount. Just mail a check to LEA, 230 Main St., Bridgton, ME 04009 or join online at www.mainelakes.org.

2008 water quality at a glance

Lake	Surface Area (acres)	Watershed Area (acres)	Max. Depth (ft)	Av. Secchi (m)	Av. Color (SPU)	Av. Chl-A (ppb)	Av. Phos. (ppb)	Av. PH	Degree of Concern
ADAMS POND	43	196	51	6.8	7	2.3	5.9	6.8	High
BACK POND	62	584	33	6.4	10	2.3	5.4	6.5	Avg/Mod
BEAR POND	250	5,331	72	5.5	14	3.6	9.9	6.6	Avg/Mod
BEAVER P. (Bridgton)	69	1,648	35	5.1	20	4.3	8.9	-	High
BEAVER P. (Denmark)	80	1,288	8	2.6	12	7.7	12.0	-	Average
BRANDY POND	733	2,300	44	6.9	11	2.7	5.6	6.8	Mod/High
COLD RAIN POND	36	505	36	4.7	14	4.6	10.0	6.7	High
CRYSTAL LAKE	446	5,345	65	5.7	15	2.6	7.3	-	Mod/High
FOSTER POND	149	1,090	28	7.8	4	2.6	5.7	6.7	Average
GRANGER POND	125	642	28	5.8	10	4.1	7.8	6.6	High
HANCOCK POND	858	2,222	59	6.8	8	2.9	5.1	6.7	Mod/High
HIGHLAND LAKE	1,295	5,101	50	7.7	9	2.3	5.6	6.6	High
HOLT POND	41	2,118	10	3.4	50	1.3	11.0	-	Average
ISLAND POND	115	1,128	48	6.1	14	2.5	6.6	-	Mod/High
JEWETT POND	43	638	41	4.7	23	3.6	9.6	-	High
KEOKA LAKE	460	3,808	42	5.8	14	3.6	8.0	6.7	Mod/High
KEYES POND	191	1,213	42	6.2	11	3.2	6.6	6.8	Mod/High
KEZAR POND	1,851	10,779	12	2.8	50	3.9	16.0	-	Average
LITTLE MOOSE POND	195	1,184	43	7.3	6	2.6	6.1	-	Moderate
LITTLE POND	33	633	13	4.2	25	2.9	9.0	-	Avg/Mod
LONG LAKE	4,935	33,871	59	6.6	12	3.0	6.4	6.7	High
LONG POND	44	217	20	5.4	5	3.3	7.0	-	Average
McWAIN POND	445	2,505	42	6.1	13	3.0	6.7	6.6	Mod/High
MIDDLE POND	72	231	50	5.7	17	2.5	9.4	6.6	High
MOOSE POND (Main)	1295	7,258	70	7.1	10	3.4	5.6	-	High
MOOSE POND (North)	323	10,462	20	3.2	25	7.6	10.0	-	Moderate
MUD POND	45	1,661	35	3.4	42	5.3	11.8	6.3	Moderate
OTTER POND	90	814	21	3.4	55	3.3	10.0	-	Moderate
PAPOOSE POND	70	192	15	3.7	23	13	16.4	-	Mod/High
PEABODY POND	740	2,522	64	6.9	7	3.5	5.4	6.8	Mod/High
PERLEY POND	68	293	27	4.0	27	4.7	8.6	6.6	Moderate
PICKEREL POND	17	290	18	5.2	13	2.2	6.0	-	Average
PLEASANT POND	604	4,624	11	1.9	95	3.9	18.0	-	Moderate
SAND POND	256	1,394	49	6.3	10	3.2	6.7	6.7	High
SEBAGO LAKE (2007)	29,526	122,551	326	9.1	10	2.0	6.2	6.7	Average
STEARNS POND	248	4,116	48	4.9	22	3.2	9.0	6.7	Mod/High
TRICKEY POND	315	555	59	9.7	2	2.0	4.7	6.8	Moderate
WOODS POND	462	3,229	29	4.9	28	3.1	7.7	6.7	Average

LEA would not be able to test the 37 lakes and ponds of this area without strong support from our surrounding community. Every year, we rely on volunteer monitors, lakefront landowners, summer interns and financial support from the Towns of Bridgton, Denmark, Harrison, Naples, Sweden, and Waterford to continue to collect and analyze lake water quality. **Thank you for all your help!**

2008 Volunteer Monitors and Lake Partners

Harold Arthur	Long Lake Marina	Blake Schindler
Richard and Andy Buck	Bob Mahanor	Jane Seeds
Camp Tapawingo	Robert Meeken	Clifton Staples
Janet Coulter	Bob Mercier	Foster & Marcella Shibles
Ken Forde	Richard and Daphne Meyer	Arthur and Jean Schilling
Kenneth Forman	Earl Morse	Nancy Shane
Jean Forshay	Naples Marina	Bob Simmons
Bill Grady	Papoose Pond Campground	Don & Pat Sutherland
Bill & Nancy Hanger	Barry & Donna Patrie	Bob & Ellen Tompkins
Janet Healey	Nancy Pike	Larry and Jan Tuck
Dick Johnson	Jean Preis	Shirley Verhoorn
Kokosing	Carol and Stan Rothenberg	Camp Wigwam
Richard LaRose	Don Rung	Rich & Nancy Worthington

2008 Water testing interns

Kevin O'Brion

Amy Tragert

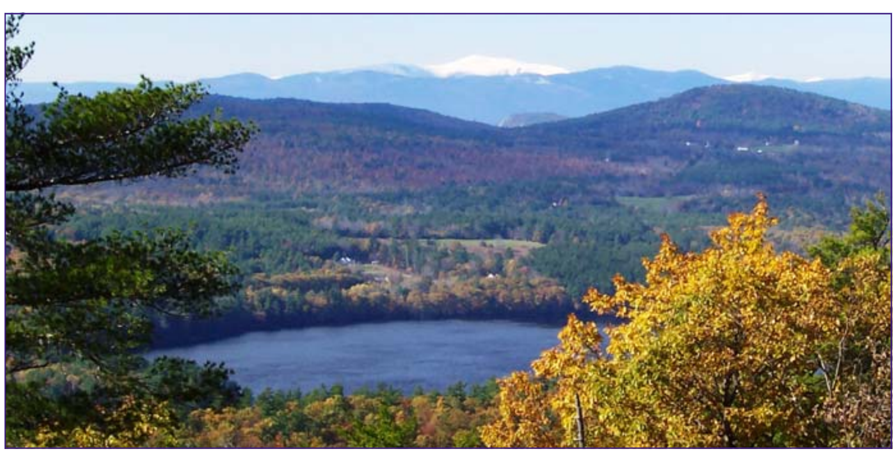
A year in the life of a lake

Winter is a quiet time. Ice blocks out the sunlight and also prevents oxygen from being replenished in lake waters because there is no wind mixing. With little light below the ice and gradually diminishing oxygen levels, plants stop growing. Most animals greatly slow their metabolism or go into hibernation.

Spring is a period of rejuvenation for the lake. After the ice melts, all of the water is nearly the same temperature from top to bottom. During this period, strong winds can thoroughly mix the water column allowing for oxygen to be replenished throughout the entire lake. This period is called spring turnover. Heavy rains, combined with snow melt and saturated soils are a big concern in the spring. Water-logged soils are very prone to erosion and can contribute a significant amount of phosphorus to the lake. Every soil particle that reaches the lake has phosphorus attached to it.

Summer arrives and deeper lakes will gradually stratify into a warm top layer and a cold bottom layer, separated by a thermocline zone where temperature and oxygen levels change rapidly. The upper, warm layers are constantly mixed by winds, which “blend in” oxygen. The cold, bottom waters are essentially cut off from oxygen at the onset of stratification. Cold water fish, such as trout and landlocked salmon, need this thermal layering to survive in the warm summer months and they also need a healthy supply of oxygen in these deep waters to grow and reproduce.

Fall comes and so do the cooler winds that chill the warm upper waters until the temperature differential weakens and stratification breaks down. As in Spring, strong winds cause the lake to turn over, which allows oxygen to be replenished throughout the water column.



The three layers of lakes

The critical element for understanding lake health is phosphorus. It's the link between what goes on in the watershed and what happens in the lake. Activities that cause erosion and sedimentation allow phosphorus from the land to be transported to the lake water.

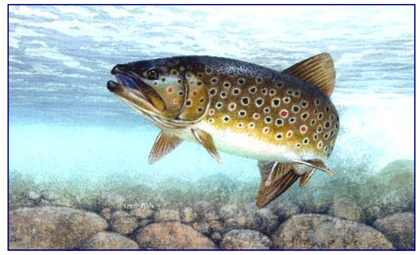
Phosphorus is a naturally occurring nutrient that's abundant on land but quite scarce in lake waters. Algae populations are typically limited by phosphorus concentrations in the water. But when more phosphorous comes into a lake, the added nutrients spur increases in algae growth.

More algae growth causes the water to be less clear. Too much algae will also use up the oxygen in the bottom of the lake. When algae die they drift to the lake bottom and are decomposed by bacteria in a process that consumes the limited oxygen supply. If deep water oxygen levels get too low, cold water fish are unable to grow or reproduce.

If there's no oxygen available at the bottom of a lake, another detrimental process called phosphorus recycling can occur. Phosphorus from sediments on the bottom become re-suspended in the water column. That doubles the lake's nutrient problem, since phosphorus is now coming from watershed as well as the lake itself.

Lake Depth

0-30 feet



Brook Trout

Epilimnion

The warm upper waters are sunlit, wind-mixed and oxygen rich.

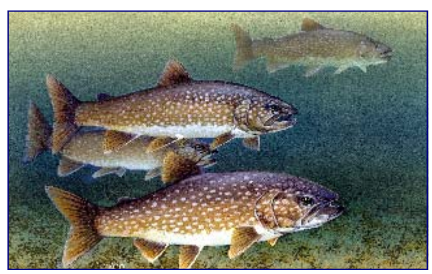
30-36 feet

Landlocked salmon

Metalimnion

This layer in the water column, also known as the thermocline, acts as a thermal barrier that prevents the interchange of nutrients between the warm upper waters and the cold bottom waters.

Below 36 feet



Lake trout, also known as togue

Hypolimnion

In the cold water at the bottom of lakes, food for most creatures is in short supply, and the reduced temperatures and light penetration prevent plants from growing.

Water Quality Testing Parameters

LEA's testing program is based on parameters that provide a comprehensive indication of overall lake health. Tests are done for transparency, temperature, oxygen, phosphorus, chlorophyll, color, conductivity, pH, and alkalinity.

Transparency is a measure of clarity and is done using a Secchi disk. An 8 inch round disk divided into black and white quarters is lowered into the water until it can no longer be seen. The depth at which it disappears is recorded in meters. Transparency is affected by the color of the water and the presence of algae and suspended sediments.

Temperature is measured at one-meter intervals from the surface to the bottom of the lake. This sampling profile shows thermal stratification in the lake. Lakes deep enough to stratify will divide into three distinct layers: the epilimnion, metalimnion, and hypolimnion. The epilimnion is comprised of the warm surface waters. The hypolimnion is made up of the deep, colder waters. The metalimnion, also known as the thermocline, is a thin transition zone of rapidly decreasing temperature between the upper and lower layers. Temperature is recorded in degrees Celsius.

Phosphorus is a nutrient that is usually present in only small concentrations in the water column. It is needed by algae for growth and reproduction and can therefore give an indication of the potential for an algal bloom. Algal blooms caused by excess phosphorus loading can deplete dissolved oxygen levels in deep water. Phosphorus is measured in parts per billion (ppb).

Dissolved oxygen is also measured at one-meter intervals from the surface to the bottom of the lake. Over the course of the summer, oxygen is depleted in the bottom waters through the process of decomposition of organic matter like dead algae. When there is excessive decomposition, all available oxygen is used up and coldwater fisheries are threatened. If dissolved oxygen concentrations are significantly depleted in bottom waters, a condition occurs which allows phosphorus to be released into the water column from bottom sediments. This is called phosphorus recycling and can cause increased algal growth to further deplete lake oxygen levels. During the fall, cooler temperatures and winds cause the lake to de-stratify and oxygen is replenished in the deep waters as the lake "turns over" and mixes. The same mixing of waters occurs in the early spring right after ice-out. Dissolved oxygen is measured in parts per million (ppm).

Chlorophyll-A is a pigment found in algae. Chlorophyll sampling in a lake gives a measure of the amount of algae present in the water column. Chlorophyll concentrations are measured in parts per billion (ppb).

Conductivity measures the ability of water to carry electrical current. Pollutants in the water will generally increase lake conductivity. Fishery biologists will often use measurements of conductivity to calculate fish yield estimates. Conductivity is measured in micro Siemens (µs).

Color is a measure of tannic or humic acids in the water. These usually originate in upstream bogs from organic decomposition. Chlorophyll results are more important on lakes that are highly colored because phosphorus and transparency results in those lakes are less accurate. Color is measured in Standard Platinum Units (SPU).

pH is important in determining the plant and animal species living in a lake because it reflects how acidic or basic the water is. pH is a measurement of the instantaneous free hydrogen ion concentration in a water sample. Bogs or highly colored lakes tend to be more acidic (have a lower pH).

Alkalinity is a measure of the amount of calcium carbonate in the water and it reflects the ability of the water to buffer pH changes. In Maine lakes, alkalinity generally ranges from 4 - 20 parts per million (ppm). A higher alkalinity indicates that a lake will be able to withstand the effects of acid rain longer than lakes with lower alkalinity. If acidic precipitation is affecting a lake, a reduction in alkalinity will occur before a drop in pH.

Water Quality Classification

While all lakes are sensitive to land use and activities within their watershed, the health and longevity of some lakes is more precarious than others. LEA classifies lakes into categories based on their overall health and susceptibility to algal blooms. Lakes in the *Average Degree of Concern* category are those lakes that are not currently showing water quality problems that are likely a result of human activity. The *Moderate Degree of Concern* category describes lakes where testing shows routine dissolved oxygen depletion, elevated phosphorus levels or a potential for phosphorus recycling. The *High Degree of Concern* category is reserved for those lakes that routinely show signs of phosphorus recycling, have a cold water fishery that is regularly impacted by oxygen depletion or have had algal blooms in the past.

The following criteria are used for reviewing transparency, phosphorus, chlorophyll and color data for each lake:

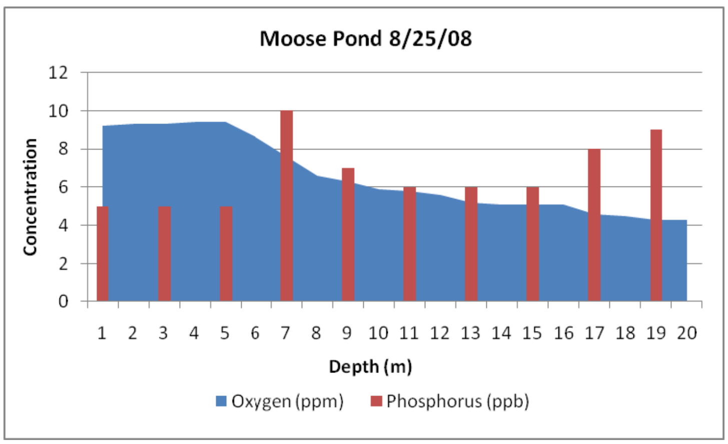
Transparency (m) in meters		Phosphorus (ppb) in parts per billion		Chlorophyll-A (ppb) in parts per billion		Color (SPU) Standard Platinum Units	
10.0 +	excellent	less than 5.0	low	less than 2.0	low	less than 10.0	low
7.1 – 10.0	good	5.1 – 12.0	moderate	2.1 – 7.0	moderate	10.1 – 25.0	moderate
3.1 – 7.0	moderate	12.1 – 20.0	high	7.1 – 12.0	high	25.1 – 60.0	high
less than 3.0	poor	20.1 +	very high	12.1 +	very high	60.1 +	very high

2008 as a Year

The good news is that in 2008, over 75% of the lakes and ponds in our service area showed a decline in phosphorus concentrations compared to their respective long-term averages. Because phosphorus is the limiting nutrient for algae populations, lower phosphorus generally results in a less algae. However, water temperature, turbidity, sunlight and the amount of biologically available phosphorus also greatly influence actual algae populations. This may explain why chlorophyll, which is a measure of the amount of green pigment found in algae, declined only on little over 50% of the lakes in our area. Water clarity results, which are influenced by sediment in the water column, algae populations and dissolved organic matter did not show strong trend for the better or worse when looking at all the lakes LEA samples.

Moose Pond Summary

Moose Pond (Main Basin) – The 2008 Secchi disk average of 7.1 meters was less deep than the long -term average of 7.4 meters for the main basin. Dissolved oxygen depletion first appeared in early August in the bottom waters of the pond. The depletion increased for the rest of the summer, impacting the bottom 12 meters of the pond by September. Phosphorus concentrations in the upper waters averaged 5.6 ppb, which is below the long-term average of 6.0 ppb. Phosphorus concentrations below the thermocline were moderate and averaged 7.4 ppb. Color averaged 10 SPU for the year, which is below the long term average of 14 SPU. pH data was not recorded this year because of erratic meter readings. Chlorophyll levels were moderate at 3.4 ppb, which is above the long-term average of 3.0 ppb. Conductivity averaged 30 µs, which is below the long term average of 39 µs and average alkalinity was 7 ppm, which is the same as the long term average. Dissolved oxygen depletion was severe in September and continues to limit the amount of suitable habitat for cold-water fish in the pond. For this reason, the main basin of Moose Pond is in the HIGH degree of concern category.



Surface Area:	1,617 acres
Maximum Depth:	70 feet
Mean Depth:	20 feet
Volume:	30,722 acres/feet
Watershed Area:	11,170 acres
Flushing Rate:	3.69 flushes per year
Elevation:	418 feet

Moose Pond Quick Statistics
2008 Average Verses the Long Term Average:

Secchi : Worse
Chlorophyll: Worse
Phosphorus: Better

Moose Pond (North Basin)- The 2008 Secchi disk average of 3.2 meters was considerably less deep than the long-term average of 5.1 meters, however there were fewer readings than normal. Dissolved oxygen depletion was observed in the bottom 3 meters of the water column. Phosphorus concentrations in the surface waters were moderate at 10 ppb, which is just above the long term average of 9.7 ppb. Alkalinity was 5 ppm, which is below the long term average of 8 ppm and color was 25 SPU, which is above the long term average of 20 SPU. Chlorophyll levels were moderate at 7.6 ppb, which is considerable higher than the long term average of 3.9 ppb. Conductivity was 23 µs, which is under the long term average of 33 µs . pH data was not recorded this year because of erratic meter readings. Due to periodic dissolved oxygen depletion in the bottom waters, the north basin remains in the MODERATE degree of concern category.